★MARL- P14 P43 98-465357/40 ★NZ 314846-A

Apparatus for grading mussels according to size, - includes a support frame and spacing adjustment means

MARLBOROUGH MUSSEL CO LTD 97.05.19 97NZ-314846

(98.08.26) B07C 5/04, A01K 80/00, B07B 13/04, 13/065

Grading apparatus comprises a plurality of elongate members (2), spacing adjustment means (3) and a support frame (4). Members (2) are mounted on and extend across frame (4). Each of the members has a first end pivotally mounted at a first side of the frame and a second end mounted on the spacing adjustment means (3) which is mounted at a second side of the frame. The first ends of members (2) are spaced at a predetermined distance apart from one another. The spacing between the second ends of members (2) is adjustable at all times by the spacing adjustment means (3). The spacing adjustment means (3) may include a rotatable shaft (10) to which the second ends of members (2) are mounted. The second ends of members (2) may rest in grooves in shaft (10) such that rotation of the shaft causes each second end to follow the path tracked by its respective groove. Rotation of shaft (10) may be by way of a hand operable lever arm (12). The second ends of members (2) may be restrained in the grooves by a bar (14). Members (2) may be rotatable and driven by a pneumatic or hydraulic motor.

N98-362463

Our Ref: MAR001

Patents Form No. 5

PATENTS ACT 1953

COMPLETE SPECIFICATION

TITLE: AN IMPROVED GRADING MEANS

We, **MARLBOROUGH MUSSEL COMPANY LTD**, A New Zealand company of Nolans Road, Grovetown, New Zealand hereby declare this invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

TECHNICAL FIELD

This invention relates to apparatus for automatically grading, or sorting, objects by size. More particularly, this invention relates to improvements in apparatus of that type.

BACKGROUND ART

In many industries, for example the horticulture and aquaculture industries, produce naturally varies in size and thus must be graded, or sorted, before sale or further use to obtain uniformity amongst the selected produce lot.

Grading or sorting can also provide a useful means of separating produce of one type from that of another. In the mussel industry grading machines are often used to separate shellfish spat into age groupings for subsequent seeding onto growing lines, thereby improving consistency in size and quality of the full grown mussels. Further, grading can be used to separate out self seeded blue lipped mussels from a batch of green lipped mussels, as they will generally be of a different size. Similarly, fruit and vegetables are often graded to achieve batches of uniform size and shape.

It has been noted that existing grading apparatus must be set up for sizing prior to commencement of the grading process. Thus, if it is noted during operation that adjustment is required to obtain correct grading the whole process must be stopped and the apparatus reset. This can be time consuming, frustrating and lends itself to inaccuracies, particularly where, for example, the aim of the grading process is to separate produce of one type from that of another.

It is therefore an object of the present invention to provide a grading apparatus which can be adjusted for size while it is running.

SUMMARY OF THE INVENTION

Accordingly, in its broadest aspect the invention provides a grading means comprising a plurality of elongate members, a member spacing adjustment means, and a support frame, the grading means being configured and arranged such that the elongate members are mounted on, and extend across, the support frame, with each of the elongate members having a first end pivotally mounted at a first side of the support frame, and a second end mounted on the spacing adjustment means which is mounted at a second side of the support frame, the first ends of the elongate members being spaced at a predetermined distance apart from one another, while the spacing between second ends of the elongate members is adjustable at all times by way of adjustment of the spacing adjustment means.

Preferably the spacing adjustment means includes a rotatable shaft to which the second ends of the elongate members are mounted, the second ends being mounted in such a manner that rotation of the shaft causes the spacing between them to change.

Conveniently each of the second ends of the elongate members rests in a corresponding groove in the rotatable shaft such that rotation of the shaft causes each second end to follow the path tracked by its respective groove.

Desirably the grooves are configured and arranged to vary the separation of the second ends of the elongate members consistently as between one adjacent set of elongate members and another.

Advantageously a first of the grooves has zero pitch, so that on rotation of the shaft the position of its corresponding elongate member second end remains the same with respect to the support frame, the adjacent groove has a pitch x, so that on rotation of the shaft the position of its corresponding elongate member second end shifts laterally an amount y, and the next adjacent groove has a pitch $2x$, so that on rotation of the shaft the position of its corresponding elongate member second end shifts laterally an amount $2y$.

Desirably the groove having zero pitch corresponds to the centre one of the elongate members, with groove either side of the centre groove being of equal, but opposite, pitch to each other.

Preferably rotation of the shaft is achieved by way of activation of a lever arm, preferably hand operably.

Conveniently the second ends of the elongate members rest in their respective grooves in the rotatable shaft, and are prevented from riding out of that groove by way of a restraining means.

Advantageously the restraining means can comprise a bar mounted parallel to, and spaced above, the rotatable shaft at high which prevents the second ends of the elongate members from riding out of their respective grooves, but which does not interfere with the ability of the elongate members to move relative to the rotatable shaft.

Desirably the elongate members are rotatable. Preferably the elongate members rotate in use, and are driven by a pneumatic or hydraulic motor. Preferably each elongate member includes its own drive motor.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 illustrates a schematic side elevation of a grading apparatus according to the present invention;

Figure 2 illustrates a schematic plan view of the grading apparatus of figure 1; and,

Figure3 illustrates the rotatable shaft of the apparatus of figure 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, the preferred embodiment of the invention illustrates a mussel grading machine as generally indicated at 1. The machine 1 includes a plurality of elongate members in the form of shafts 2, a member spacing adjustment means, as generally indicated at 3, and a support frame 4.

The machine 1 is configured and arranged such that the shafts 2 are mounted on, and extend across, the support frame 4. Each of the shafts 2 has a first end 5 pivotally mounted at a first side 6 of the support frame 4, and a second end 7 mounted on the spacing adjustment means 3, which is located at a second side 8 of the support frame 4.

The ends 5 of the shafts 2 are equispaced at a preset distance apart. The spacing between ends 7, however, is adjustable at all times by way of adjustment of the spacing adjustment means 3.

The shafts 2 are disposed at an angle to the horizontal, with the ends 5 being higher than the ends 7, thereby creating a fall so that produce tipped onto the shafts 2 has a natural tendency to move under the action of gravity from the ends 5 towards the ends 7.

Each of the shafts 2 is rotatable, with each having a pneumatic motor directly coupled to its end 5. The shaft ends 7 are mounting in bearings 9 which are mounted on the adjustment means 3. Rotation of the shafts 2 in use further encourages produce tipped onto the shafts 2 to move from the shaft ends 5 towards the shaft ends 7.

The adjustment means 3 includes a shaft 10 mounted substantially perpendicularly to the shafts 2. Bearings 11 rotatably mount the shaft 10 to the support frame 4. A handle 12 is provided at one end of the shaft 10 whereby it may be rotated. The adjustment means 3 further includes a locking mechanism (not shown) to enable unwanted rotation of the shaft 10 to be prevented.

The shaft 10 includes a number of grooves 13 along its length. The number of grooves 13 corresponds with the number of shafts 2, with the bearing 9 at the end 7 of each shaft 2 being located in a corresponding one of the grooves 13. In the preferred embodiment illustrated there are nine shafts 2, and correspondingly, nine grooves 13. The middle groove 13a circumscribes the shaft 10 at an angle perpendicular to the shaft's longitudinal axis. The next groove 13b circumscribes the shaft 10 at a pitch *x*. The groove 13c on the opposite side of the centre groove 13a circumscribes the shaft 10 at a pitch -*x*. Groove 13d has a pitch of twice *x*, and groove 13e has a pitch of twice -*x*. The remaining grooves 13 have a pitch which is determined by the formula:

x times the groove number out from the centre groove 13a

The pitch will be negative if on the same side of the groove 13a as groove 13c, or positive if on the same side as groove 13b.

The grooves 13 each have a semi-circular cross section corresponding in radius to the radial dimension of the bearings 9 at the ends 7 of the shafts 2. The depth of each groove 13 being sufficient as to locate the bearing 9 within it. A retaining bar 14 extends spaced above and parallel to the shaft 10. The bearings 9 are captured between their respective grooves 13 and the retaining bar 14, the bar preventing the bearings 9 from riding out of their grooves 13, but allowing lateral movement as the shaft 10 is rotated.

The machine 1 further includes a feed conveyor 15 to deposit mussels for grading onto a feed chute 16, which is located on the support frame 4 and is arranged to, in use, feed mussels onto the ends 5 of the shafts 2. Additionally, located below, and perpendicular to the shafts 2 are a number take off chutes 17, 18, 19. In use the chutes 17, 18 ,19 catch the graded mussels, with a particular mussel size being discharged into a particular one of the chutes 17, 18, 19. The machine 1 still further includes conveyors 20, 21, 22 which, in use, take away the mussels as they are discharged from the chutes 17, 18 ,19.

Prior to undertaking a particular grading exercise the machine 1 must be set up. This involves adjusting the spacing between the ends 7 of the shafts 2 using the adjustment means 3 so that the desired grading parameters are established. In that regard, the spacing will be determined in part by past experience of settings, and in part by an understanding of the size or material to be separated (ie: whether mussels of a particular species are being sorted merely for size, whether one species is to be sorted from another, or whether rubbish material is being sorted from the mussels.).

Once initial settings have been established the machine 1 can begin operation. To that end the pneumatic motors on the shafts 2 are started up, as are the conveyors 20, 21, 22. Next the feed conveyor 15 is started, and mussels for grading deposited on to the feed conveyor 15. The mussels travel up the feed conveyor 15, and drop onto the feed chute 16 from where they slide onto the shafts 2. As the shafts 2 are rotating, and are inclined at an angle to the horizontal, the mussels etc have a natural tendency to move down the shafts 2 towards the ends 7.

As the mussels move down the shafts 2 they, and any other material with them, drop through at the point where the spacing between adjacent shafts 2 allows. As they drop they are caught by one or other of the chutes 17, 18 ,19 and are deposed onto a corresponding conveyor 20, 21, 22 for collection.

As the sorting operation proceeds it is monitored to ensure that the desired grading is occurring. If it is noted that grading is not proceeding as expected the adjustment means 3 can be utilised to alter the spacing between the ends 7 of the shafts 2 while grading continues. This facility allows for far more efficient use of the grading machine 1 to be made, as there is little or no "down" time while adjustments are done. Further, because finer adjustment can be done while the machine 1 is operating the time taken in initial set can be significantly reduced.

Additional advantages of the present invention will become apparent to those skilled in the art after considering the principles in particular form as discussed and illustrated.

Accordingly it will be appreciated that changes may be made to the above described embodiment of the invention without departing from the principles taught herein. For example, the grooves which are provided in the shaft of the adjustment means are each indicated in the preferred embodiment as comprising a single and continuous track around the circumference of the shaft.

However, it will be appreciated that each groove could just as conveniently be a length of screw thread, so that adjustment to increase separation of the grading shafts would involve rotating the shaft of the adjustment means one way, while decreasing the separation would involve rotating the adjustment means shaft in the opposite direction.

Further, the preferred embodiment has been described as having an adjustment means at one end of the grading shafts only. However, it will be understood that to achieve greater flexibility in size and use of the grading apparatus an adjustment means can be provided at both ends, thereby increasing the range of spacing adjustment possible which can be provided between the grading shafts.

Finally it will be understood that the invention is not limited to the particular embodiment described or illustrated, but is intended to cover all alterations or modifications which are within the scope of the claims.

WHAT WE CLAIM IS:

1. A grading means comprising a plurality of elongate members, a member spacing adjustment means, and a support frame, the grading means being configured and arranged such that the elongate members are mounted on, and extend across, the support frame, with each of the elongate members having a first end pivotally mounted at a first side of the support frame, and a second end mounted on the spacing adjustment means which is mounted at a second side of the support frame, the first ends of the elongate members being spaced at a predetermined distance apart from one another, while the spacing between second ends of the elongate members is adjustable at all times by way of adjustment of the spacing adjustment means.

2. A grading means according to claim 1 wherein the spacing adjustment means includes a rotatable shaft to which the second ends of the elongate members are mounted, the second ends being mounted in such a manner that rotation of the shaft causes the spacing between them to change.

3. A grading means according to claim 1 wherein each of the second ends of the elongate members rests in a corresponding groove in the rotatable shaft such that rotation of the shaft causes each second end to follow the path tracked by its respective groove.

4. A grading means according to claim 3 wherein the grooves are configured and arranged to vary the separation of the second ends of the elongate members consistently as between one adjacent set of elongate members and another.

5. A grading means according to claim 4 wherein a first of the grooves has zero pitch, so that on rotation of the shaft the position of its corresponding elongate member second end remains the same with respect to the support frame, the adjacent groove has a pitch x, so that on rotation of the shaft the position of its corresponding elongate member second end shifts laterally an amount y, and the next adjacent groove has a pitch $2x$, so that on rotation of the shaft the position of its corresponding elongate member second end shifts laterally an amount $2y$.

6. A grading means according to claim 5 wherein the groove having zero pitch corresponds to the centre one of the elongate members, with groove either side of the centre groove being of equal, but opposite, pitch to each other.

7. A grading means according to claim 6 wherein rotation of the shaft is achieved by way of activation of a lever arm.

8. A grading means according to claim 6 wherein rotation of the shaft is achieved by way of activation of a hand operable lever arm.

9. A grading means according to any one of claims 3 to 8 wherein the second ends of the elongate members rest in their respective grooves in the rotatable shaft, and are prevented from riding out of that groove by way of a restraining means.

10. A grading means according to claim 9 wherein the restraining means comprises a bar mounted parallel to, and spaced above, the rotatable shaft at high which prevents the second ends of the elongate members from riding out of their respective grooves, but which does not interfere with the ability of the elongate members to move relative to the rotatable shaft.

11. A grading means according to any one of claims 1 to 9 wherein the elongate members are rotatable.

12. A grading means according to claim 11 wherein the elongate members rotate in use, and are driven by a pneumatic or hydraulic motor.

13. A grading means according to claim 12 wherein each elongate member includes its own drive motor to effect its rotation.

14. A grading means substantially as herein described or exemplified with reference to the accompanying drawings.

Marlborough Mussel Company Limited
by their attorneys
PETER VERBOEKET AND COMPANY
Per:

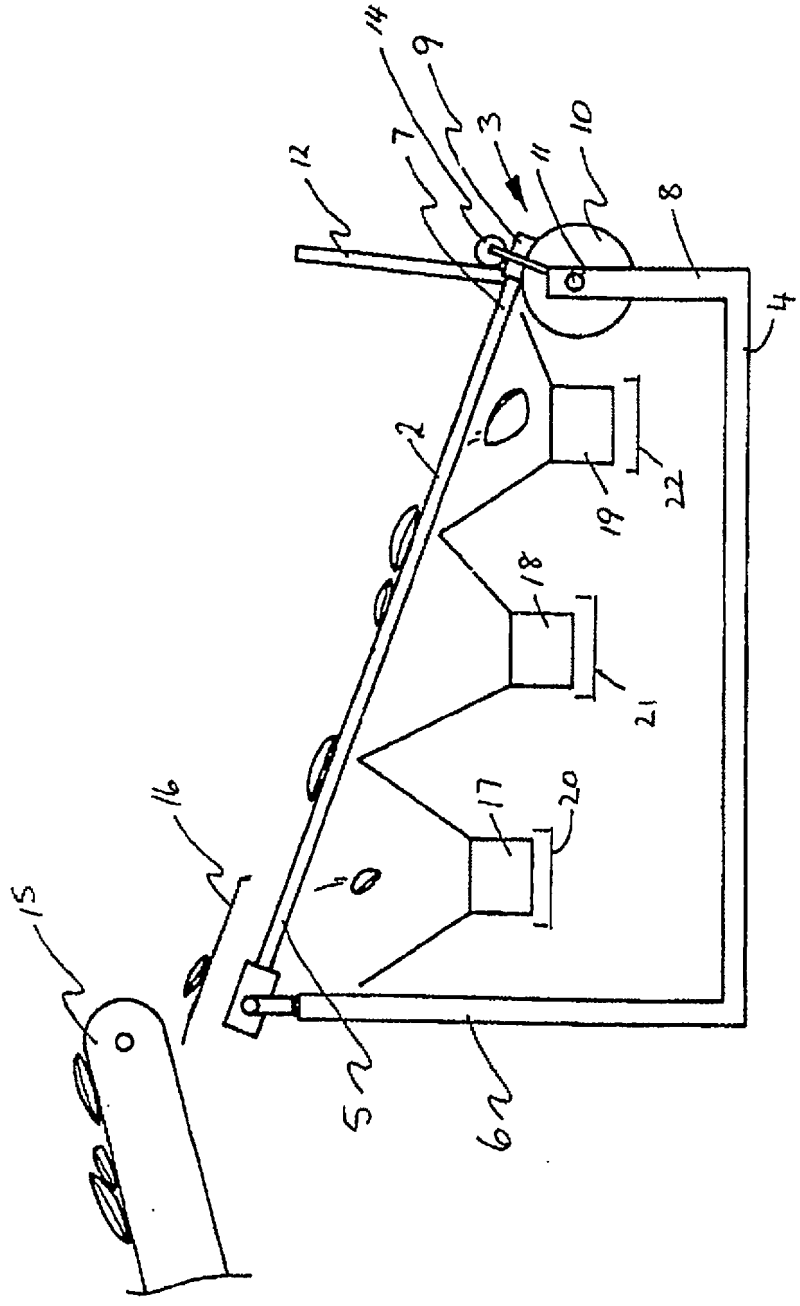

Figure 1.

MARLBOROUGH MUSSEL CO. LTD.
By their Attorneys
PETER VERBOEKET AND COMPANY
Per:

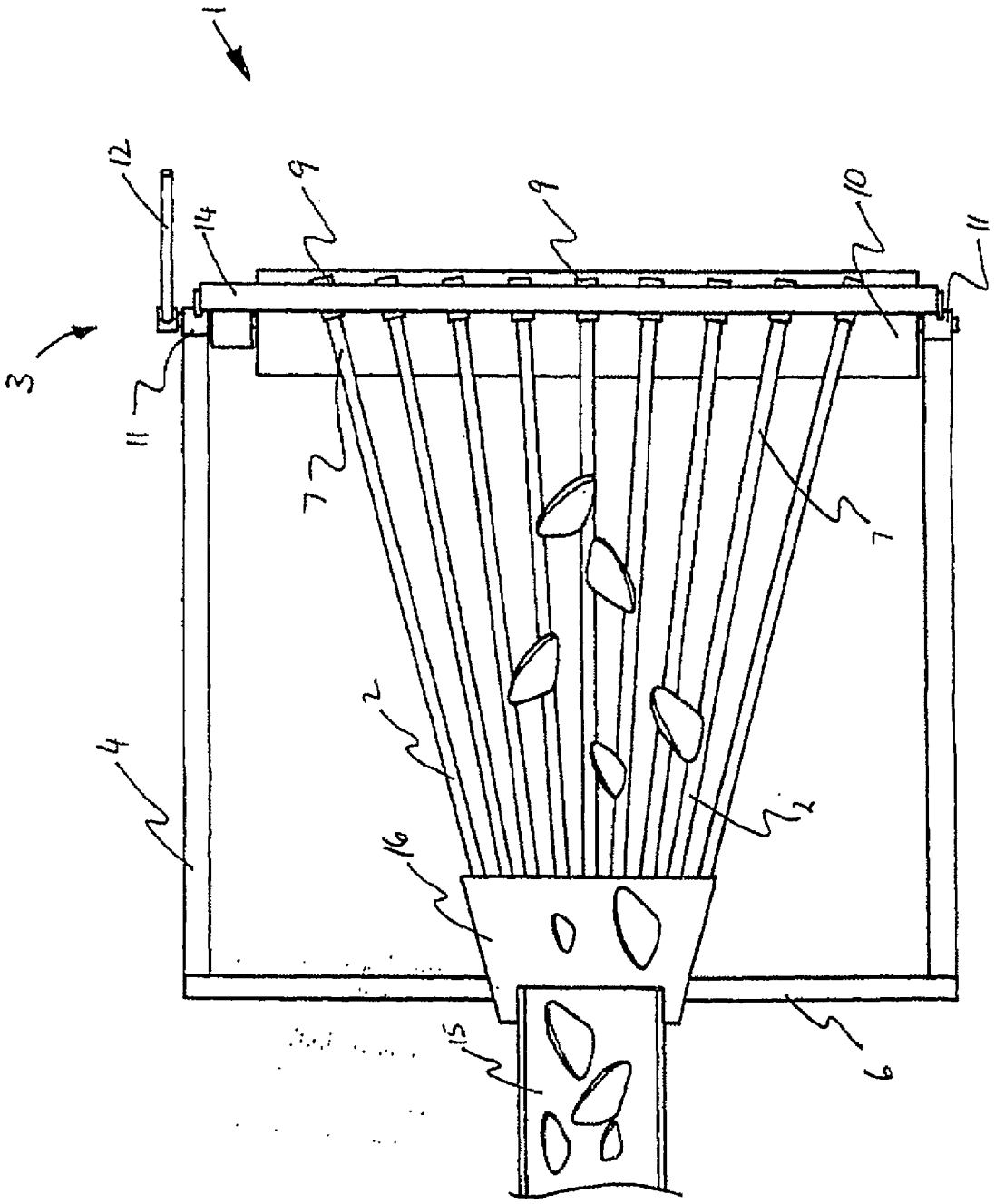

Figure 2.

MARLBOROUGH MUSSEL CO. LTD.
By their Attorneys
PETER VERBOEKET AND COMPANY
Per:

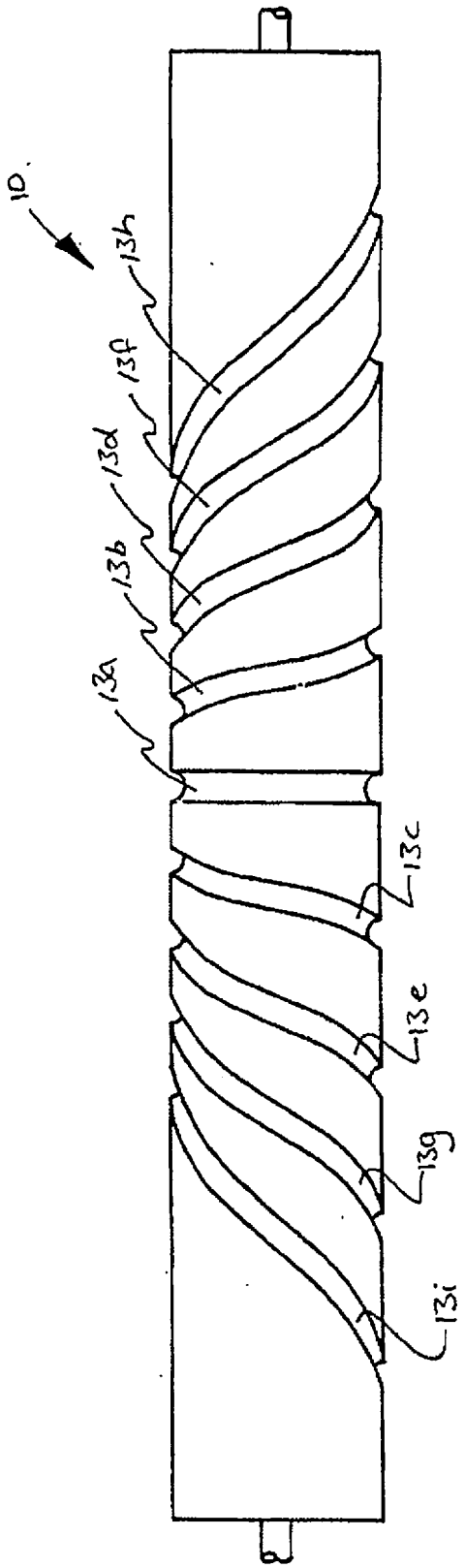

Figure 3.

MARLBOROUGH MUSSEL CO. LTD.
By their Attorneys
PETER VERBOEKET AND COMPANY
Per: